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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/815,432	03/31/2004	Peter Feldmann	Y0R920040053US1	7656
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HARRINGTON & SMITH, PC			SHARON, AYAL I	
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SHELTON, CT 06484-6212			2123	
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		04/06/2007	PAPER	

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/815,432	FELDMANN ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Ayal I. Sharon	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 18 January 2007.
- 2a) This action is FINAL.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-24 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 31 March 2004 is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All    b) Some \* c) None of:
1. Certified copies of the priority documents have been received.
  2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### *Introduction*

1. Claims 1-24 of U.S. Application 10/815,432 filed on 3/31/2004 are currently pending.

### ***Claim Rejections - 35 USC § 101***

2. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. **Claims 1-24 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.**
4. The claims in the instant application are directed to an abstract idea. One may not patent every "substantial practical application" of an idea, law of nature or natural phenomena because such a patent "in practical effect be a patent on the [idea, law of nature or natural phenomena] itself." Gottschalk v. Benson, 409 U.S. 63, 71-72, 175 USPQ 673, 676 (1972).
5. The instant claims also lack a concrete, useful, and tangible result.
6. The fundamental test for patent eligibility is to determine whether the claimed invention produces a "**useful, concrete and tangible result.**" See State Street Bank & Trust Co. v. Signature Financial Group Inc., 149 F. 3d 1368, 47 USPQ2d 1596 (Fed. Cir. 1998) and AT&T Corp. v. Excel Communications, Inc., 172 F.3d

1352, 50 USPQ2d 1447 (Fed. Cir. 1999). In these decisions, the court found that the claimed invention as a whole must accomplish a practical application. That is, it must produce a “useful, concrete and tangible result.”

7. The test for practical application as applied by the examiner involves the determination of the following factors:

- a. “Useful” – According to MPEP § 2106 (IV)(C)(2)(a), the USPTO’s official interpretation of the utility requirement provides that the utility of an invention has to be (i) specific, (ii) substantial and (iii) credible. MPEP § 2107 and In re Fisher, 421 F.3d at 1372 (citing the Utility Guidelines with approval for interpretation of “specific” and “substantial”). In addition, when the examiner has reason to believe that the claim is not for a practical application that produces a useful result, the claim should be rejected, thus requiring the applicant to distinguish the claim from the three 35 U.S.C. 101 judicial exceptions to patentable subject matter by specifically reciting in the claim the practical application.
- b. “Tangible” - Applying In re Warmerdam, 33 F.3d 1354 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is nonstatutory under 35 U.S.C. § 101. In addition, According to MPEP § 2106 (IV)(C)(3), a claim that recites a computer that solely calculates a mathematical formula, or a computer

disk that solely stores a mathematical formula, is not directed to the type of subject matter eligible for patent protection. Gottschalk v. Benson, 409 U.S. 63 (1972).

- c. "Concrete" - According to MPEP § 2106 (IV)(C)(2)(2)(a), a claimed process must have a result that can be substantially repeatable, or the process must substantially produce the same result again. In re Swartz, 232 F.3d 862, 864 (Fed. Cir. 2000) (finding that an asserted result produced by the claimed invention is "irreproducible" claim should be rejected under section 101). The opposite of "concrete" is unrepeatable or unpredictable. An appropriate rejection under 35 U.S.C. § 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.
- 8. An example of a concrete, useful, tangible result is provided in State Street, 149 F.3d at 1373-74, 47 USPQ2d at 1601-02. ("[T]he transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces 'a useful, concrete and tangible result' – a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades").
- 9. Another example of a concrete, useful, tangible result is provided in AT&T, 172 F.3d at 1358, 50 USPQ2d at 1452 (Claims drawn to a long-distance telephone

billing process containing mathematical algorithms were held patentable subject matter because the process used the algorithm to produce a useful, concrete, tangible result - a primary inter-exchange carrier ("PIC") indicator - without preempting other uses of the mathematical principle).

10. The claimed subject matter does not produce a useful, tangible result:

- a. A "Useful" result is missing because the claims fail to sufficiently reflect at least one practical utility set forth in the descriptive portion of the specification. More specifically, while the described practical utility is directed to computer-aided design tools for the simulation of physical properties of geometric structures, the claims recite the numerical solution of a linear system of equations, which are not specific practical utilities.
- b. A "Tangible" result is missing because the claimed subject matter fails to produce a result that is limited to having real world value rather than a result that may be interpreted to be abstract, such as a thought, a computation, or manipulated data. More specifically, the claims recite "determining an approximate numerical solution of the linear system of equations." There is no tangible embodiment. This produced result remains in the abstract and, thus, fails to achieve the required status of having real world value. Moreover, the claims that recites a computer that solely calculates the mathematical formula, or a computer disk that solely stores a mathematical formula, are not directed to the type of subject matter eligible for patent protection.

11. **Claims 1-24 are also rejected under 35 U.S.C. 101 because the claimed invention preempts a 35 U.S.C. 101 judicial exception. The claims preempt every “substantial practical application” of an idea – a mathematical algorithm.**
12. One may not patent every “substantial practical application” of an idea, law of nature or natural phenomena because such a patent “in practical effect be a patent on the [idea, law of nature or natural phenomena] itself.” Gottschalk v. Benson, 409 U.S. 63, 71-72, 175 USPQ 673, 676 (1972).
13. According to MPEP § 2106 (IV)(C)(3), a claim that recites a computer that solely calculates a mathematical formula (see Benson) or a computer disk that solely stores a mathematical formula is not directed to the type of subject matter eligible for patent protection.
14. All of the claims in the instant application share this defect. In particular, none of the independent claims are restricted to any field of application, and therefore the claims are directed to all possible applications of the math recited in the claims.
15. Applicants claims are directed exclusively to the mathematics, and lack any recitation of specific and substantial practical application. Examiner therefore has determined that the claims attempt to patent every “substantial practical application” of an idea – a mathematical algorithm. Thus, the claims are non-statutory.

***Claim Rejections - 35 USC § 102***

16. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

17. The prior art used for these rejections is as follows:

a. U.S. Patent 5,604,911 to Ushiro. ("Ushiro").

18. The claim rejections are hereby summarized for Applicant's convenience. The detailed rejections follow.

**19. Claims 1-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Ushiro.**

20. In regards to Claim 1, Ushiro teaches the following limitations:

*1. A method to determine a numerical solution of a linear system of equations representing a physical entity, comprising:*

(See Ushiro, especially: col.2, lines 40-62)

*generating a mesh representation of the physical entity, the mesh representation comprising mesh elements;*

(See Ushiro, especially: Fig.5 and col.8, lines 45-50; and Fig.4, steps 13-14; and col.8, lines 32-45)

*computing a linear system matrix A of coefficients by computing interactions between simple functions defined over sets of mesh elements;*

(See Ushiro, especially: Fig.4, steps 14-17; and col.8, lines 32-45)

*partitioning the mesh representation into a plurality of partitions separated by partition boundaries; and*

(See Ushiro, especially: Fig.4, steps 14-17; and col.8, lines 32-45)

*computing, using at least the plurality of partitions, a preconditioner for the linear system matrix A that is compatible with the linear system of equations and that provides at least basis function support over at least two mesh elements, where coupling of the preconditioner between partitions is only through basis functions at the partition boundaries;*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

*using at least the linear system matrix A and the preconditioner, determining an approximate numerical solution of the linear system of equations.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

21. In regards to Claim 2, Ushiro teaches the following limitations:

2. *A method as in claim 1, where the preconditioner is itself a valid solution to the same set of physical equations that govern the full linear system.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

22. In regards to Claim 3, Ushiro teaches the following limitations:

3. *A method as in claim 1, where computing a preconditioner operates to compute a preconditioning matrix K where partition boundaries are constrained to coincide with the edges of mesh elements, and to compute mesh element interactions using reduced coupling.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

23. In regards to Claim 4, Ushiro teaches the following limitations:

4. *A method as in claim 3, where mesh element interactions between basis functions are computed only for half functions within the same partition, where a half function denotes the function over any one of multiple mesh elements for which it is defined, and where the interactions of basis functions crossing a partition boundary are computed separately*

*for each of the half functions such that no interactions exist between basis function halves that are defined in separate ones of the partitions, and those basis functions completely within a partition, referred to as interior elements, interact only with other interior elements and with boundary element halves within the same partition.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

24. In regards to Claim 5, Ushiro teaches the following limitations:

*5. A method as in claim 4, further comprising sorting indices of basis functions in the matrices A and K so that all internal elements appear first, grouped according to their respective partitions, followed by all boundary elements, and where a resulting preconditioning matrix K for n partitions has the form:*

$$K = \begin{bmatrix} [[Ka_1]] & & & \\ [ & [Ka_2] & & ] \\ [ & & [Kb] & ] \\ [ & & & ] \\ [ & & [Ka_n] & ] \\ [ & [Kc] & & [Kd] ] \end{bmatrix}$$

*where the sub matrix Ka is the block diagonal matrix created by the union of the matrices of internal element interactions Kai through Ka,, Kd represents the interactions between the boundary elements, and Kb and Kc are the interactions between the internal and boundary elements.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

25. In regards to Claim 6, Ushiro teaches the following limitations:

*6. A method as in claim 5, wherein determining an approximate numerical solution, further comprises iteratively solving a system of equations Ax=f using the linear system matrix A, a vector f of boundary conditions on each mesh element and the preconditioner matrix K to provide an approximate solution x.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

26. In regards to Claim 7, Ushiro teaches the following limitations:

*7. A method as in claim 6, where the linear system matrix A is partitioned in the same manner as the preconditioner using the same partitions, separate partitions, or a combination of the same and separate partitions.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

27. In regards to Claim 8, Ushiro teaches the following limitations:

*8. A method as in claim 6, where iteratively solving comprises operating a conjugate gradient iterative solver.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

**28. Claims 9-16 and 17-24 are rejected based on the same reasoning as claims**

**1-8. Claims 9-16 are signal bearing media claims, and claims 17-24 are digital processing system claims that recite limitations equivalent to those recited in method claims 1-8 and taught throughout Ushiro.**

### ***Response to Arguments***

#### **Re: Claim Rejections - 35 USC § 101**

29. Applicants have amended claims 9-16 to recite "computer readable medium". As the applicant persuasively argues in p.15 of the amendment filed 1/18/07, this limitation is statutory according to the interim guidelines. Examiner has withdrawn the rejections based on the interpretation of the claims as encompassing a "signal bearing medium".

30. The Applicants unpersuasively argue (see p.12 of the amendment filed 1/18/07)

that “[t]he preconditioner is a ‘useful, concrete, and tangible result.’”

31. The Applicants unpersuasively argue that the precondition is useful because

“subsequent operations can use the preconditioner, e.g., for determining a numerical solution.” Examiner respectfully disagrees. The numerical solution would be useful if a specific use was claimed, (such as a stock price value in State Street), but currently the solution is not useful because no specific, substantial and credible utility is claimed. Therefore, the preconditioner is merely an intermediate step in producing a final result which lacks a specific, substantial and credible utility.

32. The Applicants unpersuasively argue that the preconditioner is concrete,

because “it can be viewed or output, if desired.” Examiner interprets this as an argument for tangibility rather than concreteness. This argument is an unpersuasive in regards to tangibility because the claims do not recite that the output is in fact stored, viewed, or output. In fact, claims 1-8 are not even directed to a computer or other apparatus, and therefore the claims are devoid of any tangibility.

33. The Applicants further argue that the preconditioner is “tangible” because it “is an entity ... which other items, such as the iterative solver of Fig. 1 can use the preconditioner, e.g. for determining the solution  $x 80$ .” Again, Examiner finds this argument to be unpersuasive because there is no specific, substantial and credible utility in the end result.

34. The Applicants unpersuasively argue that (see p.12 of the amendment filed 1/18/07. Emphasis in the original) that “[t]he Examiner appears to suggest that there must be a step of **using** the preconditioner in order to provide a ‘tangible result.’” Examiner respectfully disagrees. Examiner merely stated that the claims must produce a ‘concrete, useful, tangible’ result (as required by the case law cited by the Applicants on pp.14-15 of the amendment filed 1/18/07). The Examiner finds that that the claims still lack such a result, even after the amendments.

Re: Claim Rejections - 35 USC § 102

35. During patent examination, the claims are given the broadest reasonable interpretation consistent with the specification. See In re Morris, 127 F.3d 1048, 44 USPQ2d 1023 (Fed. Cir. 1997). See MPEP §§ 904.01, and 2111-2116.01 for case law pertinent to claim analysis.

36. Moreover, Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See In re Van Geuns, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

37. The Applicants unpersuasively argue in pp.17-18 of the amendment filed 1/18/07 that the Ushiro reference does not teach the limitation of “partitioning the mesh representation into a plurality of partitions separated by partition boundaries” because Ushiro teaches (at col.8, lines 32-45) “partitioning into sub[-]areas” rather than partitioning into “partitions”. Examiner finds this argument to be

unpersuasive, because Examiner has given the term “partition” the broadest reasonable interpretation, which Examiner finds to encompass the meaning of Ushiro’s term “sub[-]area”.

38. Moreover, the Applicants unpersuasively argue p.18 of the amendment filed 1/18/07 that the Ushiro reference does not teach that “computations are performed relative to boundaries between the partitions.” Examiner respectfully disagrees. Given that the Examiner interprets that the claimed “partitions” correspond to Ushiro’s “sub[-]areas”, then the computations taught in Ushiro (at Fig.4 and col.8, lines 32-45) are performed relative to the boundaries between the partitions.

39. All independent claims share these rejections.

40. Applicants’ argument regarding claim 5 is also unpersuasive. Ushiro’s Figures 1-3, and the associated text, and the summary of the invention (cols.2-6) are all directed to using matrices for mesh analysis of partitioned “sub-areas”.

### ***Conclusion***

41. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory

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action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Correspondence Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (571) 272-3714. The examiner can normally be reached on Monday through Thursday, and the first Friday of a bi-week, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached at (571) 272-3753.

Any response to this office action should be faxed to (571) 273-8300, or mailed to:

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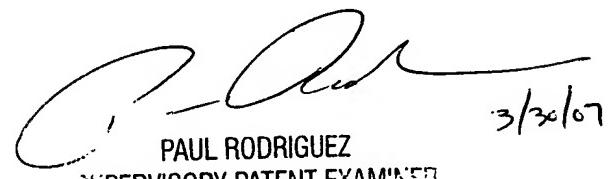
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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Tech Center 2100 Receptionist, whose telephone number is (571) 272-2100.

Ayal I. Sharon  
Art Unit 2123  
March 28, 2007

  
PAUL RODRIGUEZ  
SUPERVISORY PATENT EXAMINER  
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*3/30/07*